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ABSTRACT

This document contains a summary of a study investigating the effects of class size on the academic achievement of South Carolina's first grade students. Two classes within each of 25 school district units participated in the project. Within each of the school district units, 50 first grade students were randomly selected and assigned to the small class treatment group (class size=21 students) or the large class treatment group (class size=29 students). Two teachers within each school district unit were then randomly selected and assigned to one of the two treatment groups. Pre-testing in reading, mathematics, and language and post-testing in reading, mathematics, language, and overall achievement were done with the Comprehensive Tests of Basic Skills. In order to investigate possible confounding variables, data were also collected on student sex, race, Title I classification and kindergarten experience. Findings showed that class size did not have a significant effect on the reading, mathematics, language, or overall achievement of the first grade students involved in the project. A summary of the South Carolina First Grade Pilot Project 1975-76 is also included. (Author/JMB)

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South Carolina First Grade Pilot Project 1976-77: The Effects of Class Size on Reading and Mathematics Achievement

Summary

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SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1976-77:

THE EFFECTS OF CLASS SIZE ON

READING AND MATHEMATICS ACHIEVEMENT

SUMMARY

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SUMMARY

A Joint Effort of the

Division of Administration and Planning
Robert R. Hill, Deputy Superintendent

Office of Research
Paul D. Sandifer, Director

and

Division of Instruction
Charlie G. Williams, Deputy Superintendent

Office of General Education
Henry G. Hollingsworth, Jr., Director

Curriculum Development Section
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South Carolina Department of Education
Cyril B. Busbee, State Superintendent
Columbia, South Carolina
January, 1978

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PREFACE

The South Carolina First Grade Pilot Project was initiated in 1975-76 by the South Carolina Legislature for the purpose of assessing the impact of reducing the pupil/teacher ratio in student achievement in the State's first grade classrooms. The project was refunded by the Legislature for the second consecutive year in the South Carolina General Appropriations Act for the Fiscal Year 1976-77, Section 31, Item IV-B. Funds in the amount of $250,000 were appropriated for the project. The major portion of these moneys was provided to the participating districts for the funding of one additional first grade teacher.

The Office of Research, Division of Administration and Planning, was responsible for the development of the research design, the implementation of the design, and the evaluation of the project data. The Office of General Education, Division of Instruction, assisted in the implementation of the research design and was responsible for coordination of the funds distribution to the local school districts.

In this report, the methodology and results of the South Carolina First Grade Pilot Project 1976-77 are summarized. A more detailed account of this study is provided in the South Carolina First Grade Pilot Project: The Effects of Class Size on Reading and Mathematics Achievement, Office of Research, January, 1978. The results from the first year of the project are included in the South Carolina First Grade Pilot Project 1975-76: The Effects of Class Size on Reading and Mathematics Achievement, Office of Research, January, 1977.

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Introduction

Educators are constantly searching for interventions which could result in higher student learning as measured in terms of student achievement. In recent years, much attention has focused on the question: Does class size have a significant effect on student learning?.

Presently, both teachers and school administrators contend that a reduction in class size would result in increased student learning. This improved student learning would be a consequence of the additional time each teacher would have available to spend with the individual student, as well as a consequence of improved student and teacher attitudes towards the learning situation.

In addition to being a concern of the educator, class size is also a concern of the layman because of the financial aspect. For example, suppose a school district with an average class size of 30 students wishes to reduce the number of students in each class by 10 to obtain an average elementary class size of 20. Since the average class size would be reduced by a factor of one-third, the district budget allocated to teachers' salaries would have to be increased by a factor of one-third.

Because of the potential educational and financial ramifications of reducing class size, the South Carolina Legislature deemed necessary a pilot project concerned with the investigation of the effects of class size on South Carolina student achievement. First grade students in the State were selected as the subjects of the investigation since

the first grade would be a logical starting point for concentrating funds to reduce class size on a statewide basis.

The South Carolina First Grade Pilot Project was originally funded for the School Year 1975-76. The project was refunded for the School Year 1976-77. In this report, the methodology and results of the 1976-77 project are summarized.

Purpose of the Study

The primary purpose of this study was to investigate the effects of class size on the reading and mathematics achievement of South Carolina's first grade students. The secondary purpose of this study was to investigate the effects of class size on the language and overall achievement of South Carolina's first grade students. More specifically, this study attempted to provide answers to the following four research questions:

1. What effect does class size have on the reading achievement of first grade students?;
2. What effect does class size have on the mathematics achievement of first grade students?;
3. What effect does class size have on the language achievement of first grade students?; and
4. What effect does class size have on the overall achievement of first grade students?

Summary of the South Carolina First Grade Pilot Project 1975-76

The South Carolina First Grade Pilot Project 1975-76 examined the effects of class size on the reading and mathematics achievement of first grade students attending schools in 23 of the 92 public school districts. There were 50 project classes matched on racial composition of the student body, socioeconomic background of the students, and school curriculum. Each pair of classes contained one experimental class (referred to as the small class) and one control class (referred to as the large class). The average small class size was 19.9 students, and the average large class size was 26.7 students. Approximately, one-half of the project teachers received in-service training. Both the experimental and control class teachers for a given pair of classes either received in-service or did not receive in-service.

The questions of primary interest concerned the effects of class size, teacher in-service training, and the interaction of class size and teacher in-service training on reading and mathematics achievement. The findings with respect to the effects of class size on reading achievement revealed that the reading achievement of first grade students in small classes was significantly higher than the reading achievement of first grade students in large classes. Although the amount of increase in reading achievement was small, this increase was sufficient enough to be considered a "real" increase rather than a "chance" increase.

In mathematics, however, the difference between the achievement of first graders in small classes and the achievement of first graders in large classes was so small that these differences might have been

the result of chance alone.

Although some teachers attended special in-service training sessions during the year, there was no evidence that in-service training alone affected the achievement of first grade students in reading or mathematics.

There was evidence that the combination of class size with teacher in-service training had an effect on the reading achievement of first graders. Students in large classes whose teachers received in-service training, students in small classes whose teachers did not receive in-service training, and students in small classes whose teachers received in-service training scored significantly higher than students in large classes whose teachers did not receive in-service training. There was no evidence that any one combination of class size and teacher in-service training affected mathematics achievement more than the other possible combinations.

Additional questions concerning the effects of class size, teacher in-service training, and the interaction of class size and teacher in-service training on language and overall achievement were explored.

The results from the language achievement analyses indicated that class size, teacher in-service training, and the interaction of class size and teacher in-service training did not significantly affect the language achievement of first grade students.

The results from the overall achievement analyses indicated that the overall achievement of first grade students in small classes was

significantly greater than the overall achievement of first grade students in large classes. However, neither teacher in-service training nor the interaction of class size and teacher in-service training had any significant effects on overall achievement.

In general, the pilot project demonstrated that reading achievement and overall achievement of first graders increased as a result of reducing class size.

Hypotheses

The following hypotheses were formulated for the investigation of the 1976-77 project data:

Hypothesis I: There will be no significant difference in the reading achievement of first grade students in small classes and the reading achievement of first grade students in large classes.

Hypothesis II: There will be no significant difference in the mathematics achievement of first grade students in small classes and the mathematics achievement of first grade students in large classes.

Hypothesis III: There will be no significant difference in the language achievement of first grade students in small classes and the language achievement of first grade students in large classes.

Hypothesis IV: There will be no significant difference in the overall achievement of first grade students in small classes and the overall achievement of first grade students in large classes.

Design of the Project

The Educational Assessment Section, Office of Research, was responsible for coordinating the project at the State level and developing and implementing the research design. The Curriculum Section, Office of General Education, assisted the Educational Assessment Section in implementing the project design. Activities involved included testing the first grade students, conducting in-service workshops, analyzing the project data, and documenting the project methodology and findings. Within each of the participating districts, a District Project Coordinator was appointed by the District Superintendent to be responsible for coordinating the project at the district level. The primary activities of the District Project Coordinators included communicating project activities to the project teachers and organizing the pretest and posttest administrations.

The procedure used in the selection of the project sample for the 1976-77 project was basically the same as the one used in the selection of the sample for the 1975-76 project. The sample selection proceeded in three stages.

The first stage of the sampling procedures involved determining those districts that would participate in the 1976-77 project. The same 25 districts that met the criteria for participation in the 1975-76 project were invited to participate in the 1976-77 project.

The second stage, school selection, was necessarily restricted by school enrollment, available classroom space, commitment to the

evaluation design, and availability of local funds. The school selection was also contingent upon the ability of those schools participating in Title I Programs to meet federal regulations regarding racial distributions and paraprofessional assistance without violating any requirements of the research design.

Each of the districts which agreed to participate in the 1976-77 project was requested to select one school to participate in the project with the understanding that two project classes would be housed in that school. In an attempt to achieve representativeness with respect to district size, the decision was made to select two project schools within each of the two largest districts for a total of four project schools.

The third stage of the sampling procedure involved the selection of the first grade students within each district and school who would participate in the project. Fifty students were to be selected within each school according to a simple random procedure. Those students who were eligible to participate were restricted to non-special education first grade students who had pre-enrolled for the School Year 1976-77. Students were required to have pre-enrolled so that they could be assigned to classes prior to the first day of school.

The fifty first graders selected within each school unit were randomly assigned to one of two treatment groups, an experimental class or a control class. Twenty-one of these 50 first graders were assigned to the experimental or small class, and twenty-nine of these

50 first graders were assigned to the control or large class. Within each of the 25 school district units, there was one experimental class and one control class for a total of 25 experimental classes and 25 control classes. In other words, there were 25 class pairs.

In September of 1976, the mean experimental class size was 20.9; the mean control class size was 28.7; and the mean difference between the two classes in each of the pairs was 7.8. In May of 1977, the mean experimental class size was 20.5; the mean control class size was 28.1; and the mean difference between the two classes in each of the pairs was 7.6.

Within a given school, after the students had been selected and assigned to treatment groups, two project teachers were then selected and assigned to teach either the small class or the large class. All teachers who were under contract to teach the first grade for the School Year 1976-77 were eligible to be selected for participation in the project. There were 50 project teachers selected, twenty-five of which were assigned to the small classes; and twenty-five of which were assigned to the large classes.

The Comprehensive Tests of Basic Skills, Form S (CTBS/S), Level A, which was administered as a pretest at the beginning of the School Year 1976-77, was used to obtain three measures of the prior achievement of the first grade students in the project: pretest reading achievement, pretest mathematics achievement, and pretest language achievement.

The CTBS/S, Level B, was administered as a posttest at the end of

the School Year 1976-77 to measure the outcome achievement of the first grade students in the project. The four outcome measures of interest were posttest reading achievement, posttest mathematics achievement, posttest language achievement, and posttest overall achievement. Data were also collected on student sex, student race, student Title I classification, and student kindergarten experience for the purpose of investigating possible confounding effects that these variables might have had on the dependent variables.

For detailed information concerning all aspects of the project design and data analysis procedures, refer to South Carolina First Grade Pilot Project 1976-77: The Effects of Class Size on Reading and Mathematics Achievement.

Summary of the Results

Two factor analyses of covariance were performed to determine if significant differences in student achievement existed between the two treatment groups, the small class size group and the large class size group. The covariates were the pretest measures of reading achievement, mathematics achievement, and language achievement which were used to adjust for initial differences in student achievement that might have existed between the two class size groups. The dependent variables were the posttest measures of reading achievement, mathematics achievement, language achievement, and overall achievement. For all seven of the achievement measures, class means rather than individual student scores were used because class size, the treatment,

was implemented on a class basis rather than an individual student basis.

A summary of the results with respect to each of the four hypotheses follows:

Hypothesis I: The average or mean achievement of first grade students in small classes was not significantly different from the average or mean reading achievement of first grade students in large classes.

Hypothesis II: The average or mean mathematics achievement of first grade students in small classes was not significantly different from the average or mean mathematics achievement of first grade students in large classes.

Hypothesis III: The average or mean achievement of first grade students in small classes was not significantly different from the average or mean language achievement of first grade students in large classes.

Hypothesis IV: The average or mean overall achievement of first grade students in small classes was not significantly different from the average or mean overall achievement of first grade students in large classes.

In general, class size did not have a significant effect on the reading, mathematics, language, or overall achievement of the first

grade students involved in the project. Nevertheless, for all four achievement measures, the amount of increase in achievement favored the small classes. This increase, however, was not sufficient to be considered a "real" increase and, thus, would be considered a chance increase.

Discussion and Recommendations

The results obtained for each of the four hypotheses support the findings of previous research which indicate that class size does not affect student achievement (Taylor and Fleming, 1972).

The results indicate that "statistically" there was no difference in achievement between the small and large class size groups. However, for each subject area examined, as well as for the overall achievement, the small class size group average was higher than the large class size group average.

The results obtained for the School Year 1976-77 appear to contradict some of the findings of the study conducted during the School Year 1975-76. In the 1975-76 study, class size had a significant effect on reading and overall achievement. There are three feasible reasons for the inconsistency in the findings for the two years.

First, the contradictions in several of the results could be attributable to the imbalance of Title I students in the two class size groups. Since the large class size groups had a smaller proportion of Title I students than the small class size group, a slight bias favoring the large class size group might have existed.

Second, nationally standardized measures were used to assess the pretest and posttest achievement levels of the students. Tests that are constructed and standardized for students in other regions of the country may not be measuring objectives relevant to a South Carolina study. Thus, a test that is constructed and standardized for South Carolina first grade students would be more appropriate.

Third, there were major changes in the design of the project for the second year. During the first year of the project, paraprofessional assistance was permitted; and teacher in-service varied on a school-by-school basis. However, during the second year of the project, paraprofessional assistance was not permitted; and all teachers received in-service training. These changes in the project design could possibly account for the inconsistencies found in the findings for the two years.

Future analyses of the 1976-77 project data should include analyses of various subgroups of students. The class size data should be analyzed by sex, race, and ability. The Office of Research plans to conduct these analyses in the future as a supplement to this report.

The contradictions found in the 1975-76 and 1976-77 studies provide evidence of the need for continued research in this area. Several recommendations concerning the project design are provided in the event that this type of study is continued or is conducted elsewhere.

1. Perhaps the most important revision needed concerns the measurement of the dependent variable, outcome achievement. An instrument or test should be designed to measure the outcome

variables (whether cognitive or affective in nature) of the study; and, furthermore, this instrument should be piloted on a sample of the target population.

2. The experiment should be carried out for a three-year period on the same group of students rather than for two one-year periods on different groups of students. A longitudinal design would ensure that any exhibited differences are "true" differences and not just differences attributable to the influence of the experiment itself (Balow, 1969; Furno and Collins, 1967). Additionally, a longitudinal experiment would enable the researcher to determine the long-term effects rather than just the short-term effects that could possibly be a result of an individual's awareness that he is participating in an experiment, the "Hawthorne Effect" (Roethlisberger and Dickson, 1940).
3. The incorporation of three or more class size groups instead of two class size groups would be beneficial. The desired design would require the examination of the effects of "very small classes", "small classes", "medium classes", "large classes", and "very large classes" on student achievement. The literature indicates that there are perhaps "critical breakpoints" between class size groups where differences in student performance are maximized (Olson, 1971). This design, however, is perhaps impractical because of the funds that would be necessary to conduct such a study.

4. Variables measuring teaching techniques, teacher attitudes, student attitudes, student classroom behavior, classroom environment, and amount of time spent on instruction in the subject areas of interest should be examined. Additionally, indicators of the classroom educational process should be assessed on the basis of individualization, interpersonal regard, group activity, and creativity (Olson, 1971). The measurement of several of these variables would necessitate classroom observations of students and teachers.
5. Subgroups of students based on age, race, sex, ability, and socioeconomic status should be examined to determine if reducing class size results in higher achievement for one subgroup than for other subgroups under experimental conditions.

These recommendations allude to just a few of the many problems that need to be corrected and questions that need to be answered. If a project of this type should continue, an attempt should be made to incorporate these recommendations. If significant effects favoring the small class are found, a careful study of "cost implications" should also follow the analysis.

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